PROJECT facts

DEPARTMENT OF ENERGY
OFFICE OF FOSSIL ENERGY

OIL recovery PROGRAM

PREDICTING THE PERFORMANCE OF HORIZONTAL WELLS

PRIMARY PROJECT PARTNER
Stanford University
Stanford, CA

FOSSIL ENERGY PROGRAM
Oil Technology Program
Oil Recovery Supporting Research

MAIN SITE
Stanford, CA

OTHER LOCATION
Marathon Technology Center
Littleton, CO

TOTAL ESTIMATED COST
DOE - $2.1 million

DE-FG22-92BC 14862

Project Description

Oil producers in many areas of the country are finding that drilling horizontal wells—starting a well downward, then angling out through the length of the reservoir—can significantly increase the flow of crude oil, often restoring economic life to an aging field. But since horizontal drilling is not yet a precise science and is more expensive than vertical drilling, operators must have confidence that it will actually produce the predicted results before investing in the technology.

Stanford University researchers are assessing the performance of horizontal wells through sophisticated modeling and reservoir analyses. The goal is to develop modeling and simulation techniques that will provide operators with the quantitative tools to predict horizontal well performance in a variety of reservoir types and conditions.

Using Stanford's computer modeling of complex reservoir structures and large-scale flow experiments at the Marathon Research Center that simulate reservoir conditions, the University researchers hope to develop an accurate set of specifications that will allow operators to determine whether horizontal wells make technical and economic sense for their specific fields. The results could be a major step forward in the widespread acceptance of a technology that will boost the Nation's oil production.

Program Goal

Horizontal drilling, known since before mid-century, has come into its own with modern improvements in control of bit direction and distance, and has resulted in significant incremental oil production in many areas of the U.S. Typically, horizontal production wells are used to contact more of the reservoir, intersect fractures which may contain oil, or prevent the production of gas from above or water from below a thin oil interval.

However, detailed knowledge of the reservoir strata—rock type, structure, thickness, continuity, oil content—is essential to guide optimal placement of the horizontal wellbore. Stanford and Marathon researchers are developing reservoir simulation processes that operators can use to determine the most efficient way to apply horizontal drilling in their oil fields. Successful development of these guidelines will help producers lower operating costs, increase production, avoid inefficient recovery processes, and lead to increasing acceptance and implementation of horizontal drilling throughout the industry.

Project Partners

MARATHON OIL Littleton, CO	**TEXACO** Houston, TX	**UNION PACIFIC** Fort Worth, TX	**CHEVRON** La Habra, CA
BP EXPLORATION Houston, TX	**AMOCO** Tulsa, OK	**PETROBRAS** Dallas, TX	**INTEVEP** Caracus, Venezuela
AGIP Milan, Italy	**NORSK HYDRO** Stavanger, Norway	**IFP/ARTEP** Paris, France	**MOBIL OIL** Dallas, TX
U. S. DOI/MIN. MGT. SVC. Camarillo, CA			

Predicting the Performance of Horizontal Wells

Project Benefits

In the 1980s, a new surge of interest developed in horizontal drilling as many operators searched for more effective means to keep declining oil fields in production. Compared with a conventional vertical well, a horizontal well contacts more reservoir area, often intersecting many times the number of natural fractures that can carry oil through a formation. The result is often an increase in the flow of oil. Some companies have reported increases in production rates of 3- to 10-fold, and in areas such as the Austin Chalk region of Texas, horizontal drilling has led to the revitalizing of production in fields once almost given up as depleted.

But horizontal drilling isn't the answer for every application. Although the technology as well as the costs for angling a well through a reservoir is established, there are still problems with well completion and operation. Performance levels cannot always be predicted with reasonable accuracy. Many operators, therefore, are reluctant to make the larger financial investment necessary to try horizontal drilling.

Stanford and Marathon's successful completion of the large-scale well-bore flow experiment and development of more accurate computer modeling and reservoir assessment techniques will give the natural gas and oil industry better tools to design horizontal well applications and predict their performance. The result could be greater industry acceptance of a technique that might help the United States recover a much larger volume of gas or oil from complex reservoirs. Such an outcome would mean more jobs created or retained in U.S. gas and oil fields, and the reduction of foreign oil imports.

CONTACT POINTS

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Cost Profile (Dollars in Millions)

	Prior Investment	FY95	FY96	FY97	Cost to Complete
Department of Energy*	$0.77	$0.43	$0.44	$0.46	-
Private Sector Partners	-	-	-	-	-

* Obligated Funding

Key Milestones